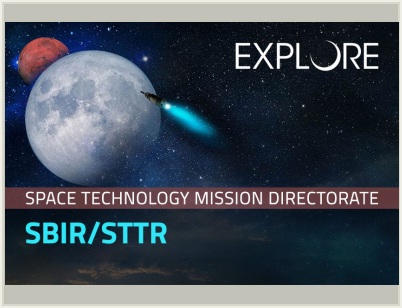
A Rapid Model Fitting Tool Suite, Phase I

Completed Technology Project (2011 - 2011)

Project Introduction

Instruments flown on board NASA missions often do not measure quantities of interest to scientists directly, but rather observable quantities. In addition, instruments often introduce artifacts into the data and techniques are needed to remove them. In both cases, scientifically relevant information can be inferred by simulating a parameterized model and adjusting the parameters to best match observed data. This minimization process of "fitting" a model to data is computationally demanding, since it requires evaluating the often complex models many times and minimizing a function of many variables. Fast, more efficient fitting techniques are therefore required in order to fully harvest the scientific output from NASA missions. In this project, we will develop a fast, general-purpose parameter fitting software tool suite taking advantage of inexpensive, high-performance graphics processing units (GPUs). The goal of Phase I of this project is to demonstrate the feasibility of model fitting on GPUs. We will therefore prototype forward models, relevant mathematical operators and the actual parameter adjustment algorithm on GPUs and compare their performance to a pure CPU implementation. We will particularly focus on ease of use for the scientist to migrate their applications to this infrastructure. During Phase I, the TRL will increase from 3 to 4. In the Phase II, we will then harden the prototypes developed in Phase I and provide alternative modeling algorithms to support a broader range of applications. In addition, we will work with scientists from various NASA missions, including the Stratospheric Aerosol and Gas Experiment (SAGE) III mission and the Solar Dynamics Observatory (SDO) to accelerate their modeling needs. In addition to NASA missions, other federal or commercial applications requiring to adjust model parameters to fit large sets of observed data will benefit from this project.



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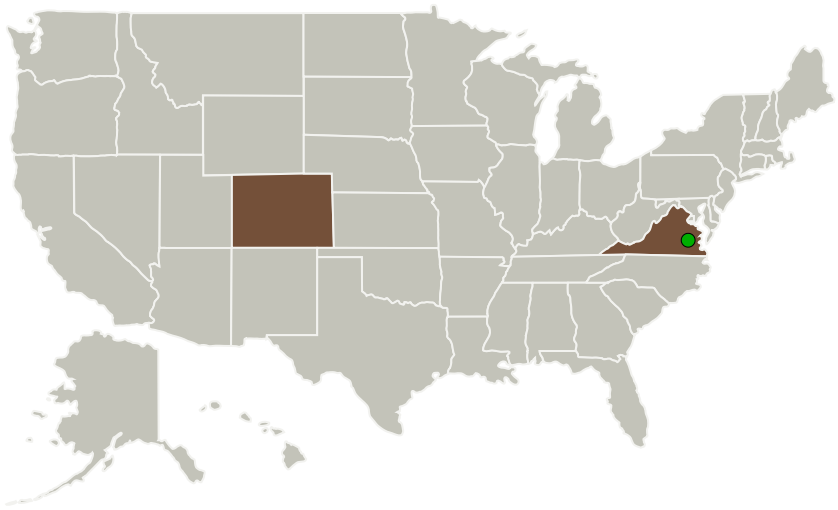
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Tech-X Corporation	Lead Organization	Industry	Boulder, Colorado
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Colorado	Virginia

Project Transitions

February 2011: Project Start

August 2011: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140163)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Tech-X Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

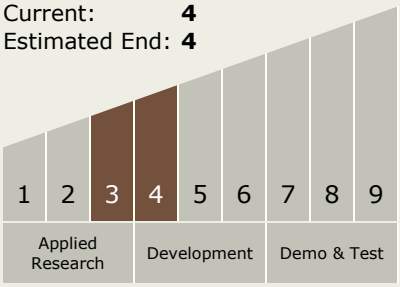
Carlos Torrez

Principal Investigator:

Michael Galloy

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.4 Information Processing
    - TX11.4.4 Collaborative Science and Engineering

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System